

Title: Pyramid of Patterns

Brief Overview:

This unit is designed to be three days of 45 minute lessons where the children will use patterns as a tool to discover secrets left behind from the Pattern Pharaoh. This unit is designed to help students identify pattern cores, sequences, and terms; use function tables; identify Pascal's Triangle; and use manipulatives with a teacher model in a cooperative group setting.

NCTM 2000 Principles for School Mathematics:

Equity: *Excellence in mathematics education requires equity - high expectations and strong support for all students.*

Curriculum: *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*

Teaching: *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*

Learning: *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*

Assessment: *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*

Technology: *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

Content Standards

Number and Operations

Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Understand meanings of operations and how they relate to one another.

Compute fluently and make reasonable estimates.

Algebra

Understand patterns, relationships, and functions.

Represent and analyze mathematical situations and structures using algebraic symbols.

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

Geometry

Analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

Data Analysis and Probability

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate instances and predictions that are based on data.

Understand and apply basic concepts of probability.

Process Standards

Problem Solving

Build new mathematical knowledge through problem solving.

Solve problems that arise in other contexts.

Apply and adapt a variety of appropriate strategies to solve problems.

Monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof

Recognize reasoning and proof as fundamental aspects of mathematics.

Make and investigate mathematical conjectures.

Develop and evaluate mathematical methods and proofs.

Select and use various types of reasoning and methods of proof.

Communication

Organize and consolidate their mathematical thinking through communication.

Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Analyze and evaluate mathematical thinking and strategies of others.

Use the language of mathematics to express mathematical ideas precisely.

Connections

Recognize and use connections among mathematical ideas.

Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

Recognize and apply mathematics and contexts outside of mathematics.

Representation

Create and use representations to organize, record, and communicate mathematical ideas.

Select, apply, and translate among mathematical representations to solve problems.

Use representations to model and interpret physical, social, and mathematical phenomena.

Grade/Level:

Grades 3-4

Duration/Length:

Three days of 45 minute sessions

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

Basic understanding of patterns

Skip counting

Basic understanding of shapes

Using a rubric

Making and using a function table

Student Outcomes:

Students will:

be able to recognize and create a pattern.

read and construct a function table.

be able to identify patterns in Pascal's Triangle.

use multiple problem solving strategies.

Materials/Resources/Printed Materials:

Pattern block stickers or stamps

Copies of Pascal's Triangle

Sentence strips

Overhead projector

Development/Procedures:**Day One: Under Construction!**

Tell students that they are going to learn how they built the great Pattern Pyramids!

First, introduce the concept of a pyramid. The teacher should present the class with a 3D model of a pyramid and point out that there are four sides in this pyramid, and that the base of this pyramid is a square. Discuss briefly that the pyramids can be found in Egypt.

The students will be told that they are all archeologists in search of a buried treasure hidden deep within a pyramid. (**Display Student Resource #1.**) They will first have to discover how many men it took to construct such a massive structure using NO machines or modern technology. Teacher will explain that it took two men to move one block per day.

It was NOT possible to have the same man move more than one block per day because he would be exhausted. The teacher will start by creating a function table on the board or overhead showing that one block needs two men. The teacher will then ask how many men it will take to move three blocks.

Rule: It takes two men to move one block.

Blocks	Men
1	2
2	4
3	6
4	8
5	10



Once the results are gathered, the teacher will place that information on the board as well. This will give the class two entries in the function table. **(Display Student Resource #2.)** Once the class sees the pattern, they can work in cooperative groups to find how many men it took to build a thirty-block pyramid. The answer the teacher should be looking for is 60 men to move 30 blocks. Once the groups have finished their assignment, they will be asked to write how they discovered their answer. The writing MUST include a CLEAR description of every process the group used and must include two types of problem solving strategies (i.e., picture, model, table, etc). See attached rubric. **(Display Student Resource #3.)**


Extension: As an extension, the students will be asked to solve the following problem: If it takes one day to move five blocks using two men, how many blocks will be moved by day fifteen? Once again, the students will need to create a table and write their responses using problem-solving strategies.





Day Two: Digging for Gold! (Display Student Resource #4.)

Tell the class that they are moving into the pyramid and will come across some very old and very secret hieroglyphics on the walls that will help them find a clue as to where the treasure may be hidden. The teacher will need to have sentence strips with patterns placed on them with the pattern stickers or stamps. The teacher will present a sentence strip with a pattern on it and explain the pattern

Example:


 A B A B





 A B A C




 A B C A









 A B C D A B C D

(Please note. . . This is a Wingding font, and not real Hieroglyphics.)

Model examples until students show an understanding of the concept. Divide the class into cooperative learning groups and ask each group to create four to six patterns using the sentence strips and the pattern stickers/stamps. (**Display Student Resource #5.**) The teacher will explain that each pattern is equal to a numeral (for example, an ABAB patterns is the equivalent to the number one. An ABCABC is equivalent to the number two. (This key should be posted in the room while the class is in groups creating their patterns). After each group has created one pattern per student, the group will write the combination before they pass the patterns to the next group. The teacher will check each group for understanding and ask for questions. After exchanging patterns, the groups will solve the patterns and appoint a messenger to go to the group from hence the pattern originated and check for accuracy. If the combination is correct, access into the vault will be obtained. If the combination is NOT correct, the messenger will return to his/her group and changes will be made until the combination is correct. Once all the groups have created and solved a pattern sentence, they will be hung in the room as hieroglyphics.

Extension: The student will write a short story using information provided in the unit. The story should include smells, sounds, sights and artifacts they might be discovering. The story should be descriptive and creative. The rubric should be teacher made and can be done in groups in desired.

Day Three: Pascal's Puzzles (Display Student Resources #6 and #7.)

The class will review the outcomes of the activities to date. Tell the students that upon entering the pyramid, they discover one wall covered in Pascal's Triangle. The teacher should refer to the explanation attached within the unit. The teacher will distribute a copy of Pascal's Triangle to each student.. The instructor will then ask students to find as many patterns as possible. After five minutes the class will share discoveries by using an overhead of the triangle. The instructor will explain that there are more patterns to be found. The students will be given another five minutes to think/pair/share to find more patterns. Again the class will reconvene to discuss new patterns that have been discovered. Using the teacher's resource in the unit, explain all possible patterns.

Extension: Have students create their own patterns within a pyramid shape. Students will share finished products with the class.

Performance Assessment: Let's Go Home!

Evaluation will be based on results from **Teacher Resources #8 and #9**. The students will be required to complete a function table, create their own pattern key like Student Resource #5, and create their own pattern as well.

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Congratulations!

CONGRATULATIONS _____!

YOU HAVE CRACKED THE CODE TO PASCAL'S PUZZLE AND
DISCOVERED THE TREASURES THAT WERE HIDDEN WITHIN.
YOU HAVE DONE THE WORLD A GREAT FAVOR, AND YOUR
NAME WILL BE REMEMBERED FOREVER! NICE WORK MY
YOUNG ARCHEOLOGIST. THANK YOU!

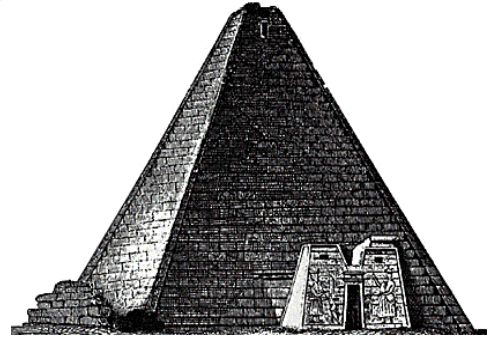
Pyramid of Patterns

Welcome to the Lost Ruins of the ancient people of Patternia. These people built pyramids from patterns they found in their environment. The Patternians also were able to create their own patterns. The people of Patternia were hard workers and prospered by building pyramids made of patterns. The pyramids were constructed as a place of worship for people who influenced math as we know it like Einstein, Pascal, and Fibonacci. After the people built a few pyramids the neighboring country of Foxville were very jealous of what the Patternians were able to build. So, in anger, the Foxvillians buried the Patternians and their pyramids in very deep sand in hopes that NOBODY would ever find them.

Just a few weeks ago, a team of clog dancers discovered the very tip of a pyramid and your class has been called in to uncover the mysteries. Our goal is to uncover all the treasure hidden within the pyramid. The pyramid is enormous. We learned that the pyramids were difficult to build and in the information we discovered, we see that most of what needs to be learned is too difficult. So, we have called on your class, the bravest and brightest of the archeologists to uncover and unravel the lost secrets of the Patternia people. We hope your work is not too dangerous and we hope you like adventures, because you will have one here.

Good Luck!

Under Construction

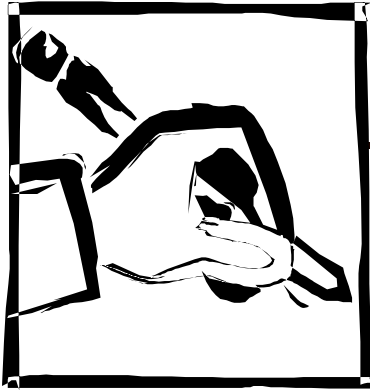


Building a pyramid required many men, because the Patternians did not have modern technology. Each block for the pyramid was huge and took two men to carry each block. After the men carried one block they could never carry another block because it was such exhausting work. It would take four men to carry two blocks and six men to carry three. As a group, let's think how many men are needed to carry three blocks.

The Patternians continued to build a thirty block pyramid. Work in groups to decide how many men are needed to carry all the blocks. When your team has the solution, write a description of how you found the answer. Give enough details for the archeologists to understand how you discovered such important information.

Rubric

- 3 -- Accomplishes the purpose of the question.
Mathematical communication is clear.
- 2 -- Partially accomplishes the purpose of the question. Mathematical communication lacks total clarity.
- 1 -- Shows limited understanding in response to the purpose of the question.
Mathematical communication is not clear.



The Writing on the Wall

As the archeologists enter the pyramid, you discover that the hieroglyphics are written in the form of patterns. So, your job as an archeologist is to decode the patterns to crack the code to the combination to the secret vault. Your job will not be easy, so the leader of your expedition will do some practice code cracking before you break into groups. After you have mastered the examples, you will work with your group to create a pattern and then give it to another group to try to crack. Be sure to write the combination to the patterns before you pass it. When the other group thinks they have cracked your code, they will ask you if the combination they have is correct. Please use the key to get the correct number for each combination.

Good Luck and Watch for MUMMIES!

Key to the code:

ABAB Pattern = 1

ABAC Pattern = 2

ABC Pattern = 3

ABCD Pattern = 4

ABBA Pattern = 5

AABB Pattern = 6

So...

1. ଡିଡିଡିଡିଡି ABABABAB..... 1

2. ଡେଡ଼େଡ଼େଡ଼େଡ଼େଡ଼େ
ABACABAC..... 2

**3. ତରୁତରୁତରୁତରୁତରୁ
ABCABCABCABCABC.... 3**

4. **అతిపెద్ద అక్షరాలను**
AABBABBAABBAABBAABB... 6

[illegible]

So, from this example, the code would read in order of the patterns. The code is 1, 2, 3, 6, 4.

REMEMBER to write numbers on each pattern to keep them in order! Good Luck Archeologists!!



We enter the tomb to find one entire wall covered with Pascal's Triangle. We learn that Blaise Pascal was a French mathematician, philosopher, and scientist who lived from 1623-1662. Each archeologist will get a copy to search for patterns. You will have five minutes to search, then we will share our findings.

Now we will Think/Pair/Share for five minutes to find more patterns.

**Be Prepared for Danger Young
Archeologists!**

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Now that you have solved the Pattern Puzzles, discovered the Treasure, and saved the day, it is time to go home. In order to get out, you have to solve a few problems.

A wall collapsed while we were looking for the treasure and now we have to dig our way out. Our leader is able to carry five buckets of sand out and the rest of the team can only carry four buckets each. How many people will we need to carry out 33 buckets of sand?

Then, before we hop on the plane to fly home, we need to leave a SECRET code for the next archeologists who might visit here after us. So, take a minute and make your own code key and a secret combination to the lock we will put on the pyramid. Do that and we are on our way home! Check your work, and don't lock yourself inside! Thanks again for all your help. Pascal's treasures are all yours and you are now a

HERO!

Sample keys for Assessment #1

People	Buckets of Sand
1	5
2	9
3	13
4	17
5	21
6	25
7	29
8	33
9	37

(The rule is the number of people times four plus one)

#2

The rubric for the second assessment will be based on a rubric graded similar to the activity titled Writing on the wall. The students need to create their own pattern and key.

PASCAL’S TRIANGLE

THE SOURCE OF MANY PATTERNS

